VOLUME 33 · NUMBER 28 · OCTOBER 1 2015

JOURNAL OF CLINICAL ONCOLOGY

ORIGINAL REPORT

Results of the Exercise and Nutrition to Enhance Recovery and Good Health for You (ENERGY) Trial: A Behavioral Weight Loss Intervention in Overweight or Obese Breast Cancer Survivors

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A B S T R A C T

Purpose

Obesity increases risk for all-cause and breast cancer mortality and comorbidities in women who have been diagnosed and treated for breast cancer. The Exercise and Nutrition to Enhance Recovery and Good Health for You (ENERGY) study is the largest weight loss intervention trial among survivors of breast cancer to date.

Methods

In this multicenter trial, 692 overweight/obese women who were, on average, 2 years since primary treatment for early-stage breast cancer were randomly assigned to either a group-based behavioral intervention, supplemented with telephone counseling and tailored newsletters, to support weight loss or a less intensive control intervention and observed for 2 years. Weight and blood pressure were measured at 6, 12, 18, and 24 months. Longitudinal mixed models were used to analyze change over time.

Results

At 12 months, mean weight loss was 6.0% of initial weight in the intervention group and 1.5% in the control group ($P < .001$). At 24 months, mean weight loss in the intervention and control groups was 3.7% and 1.3%, respectively ($P < .001$). Favorable effects of the intervention on physical activity and blood pressure were observed. The weight loss intervention was more effective among women older than 55 years than among younger women.

Conclusion

A behavioral weight loss intervention can lead to clinically meaningful weight loss in overweight/obese survivors of breast cancer. These findings support the need to conduct additional studies to test methods that support sustained weight loss and to examine the potential benefit of intentional weight loss on breast cancer recurrence and survival.

J Clin Oncol 33:3169-3176. © 2015 by American Society of Clinical Oncology

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Published online ahead of print at www.jco.org on August 17, 2015.

Written on behalf of the Exercise and Nutrition to Enhance Recovery and Good Health for You Trial Group.

Support information appears at the end of this article.

Clinical trial information: NCT01112839.

Authors' disclosures of potential conflicts of interest are found in the article online at www.jco.org. Author contributions are found at the end of this article.

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0732-183X/15/3328w-3169w/$20.00

DOI: 10.1200/JCO.2015.61.1095

INTRODUCTION

Breast cancer is the most common invasive cancer in women, currently accounting for 29% of all new cancers among women in the United States.[1] Improvements in survival after the diagnosis of breast cancer have resulted in an increasing number of breast cancer survivors, now estimated at more than 2.9 million women.[2] Among breast cancer survivors, obesity is associated with a 33% increased risk for all-cause and breast cancer mortality.[3] Further, obesity is associated with adverse metabolic and cardiovascular disease risk factors and comorbidities such as type 2 diabetes, hypertension, and cardiovascular disease.[4,5] Obesity also contributes to enduring psychosocial problems, physical impairments, lower quality of life, and treatment-related adverse effects.[6] Arthralgias and myalgias can result from both chemotherapy and adjuvant endocrine therapy and are among the factors that often make weight management efforts more challenging in this population.[7] The concern about obesity and cancer has prompted the American Society of Clinical Oncology (ASCO) to develop a position statement on obesity and cancer, as well as resources to encourage oncology professionals to address this issue with their patients.[8]

The effect of a weight loss intervention in overweight or obese breast cancer survivors has been

examined in a few prior studies, as previously reviewed.[9] The multicenter Exercise and Nutrition to Enhance Recovery and Good Health for You (ENERGY) study is the largest weight loss study in this patient population to date, enrolling 692 overweight or obese women who had been diagnosed and treated for early-stage breast cancer.[10] The primary end point for this randomized controlled trial (RCT) was weight loss measured at 1- and 2-year follow-up. Secondary aims included the exploration of effect modifiers (eg, time since diagnosis, type of tumor and therapy) on weight loss at 24 months. We hypothesized that a behavioral weight loss intervention emphasizing increased physical activity and tailored to this population would result in greater weight loss in the intervention group compared with a control group assigned to a less intensive intervention.

METHODS

Study Design

A detailed description of the ENERGY study procedures and intervention has been published previously.[10] This RCT featured a group-based

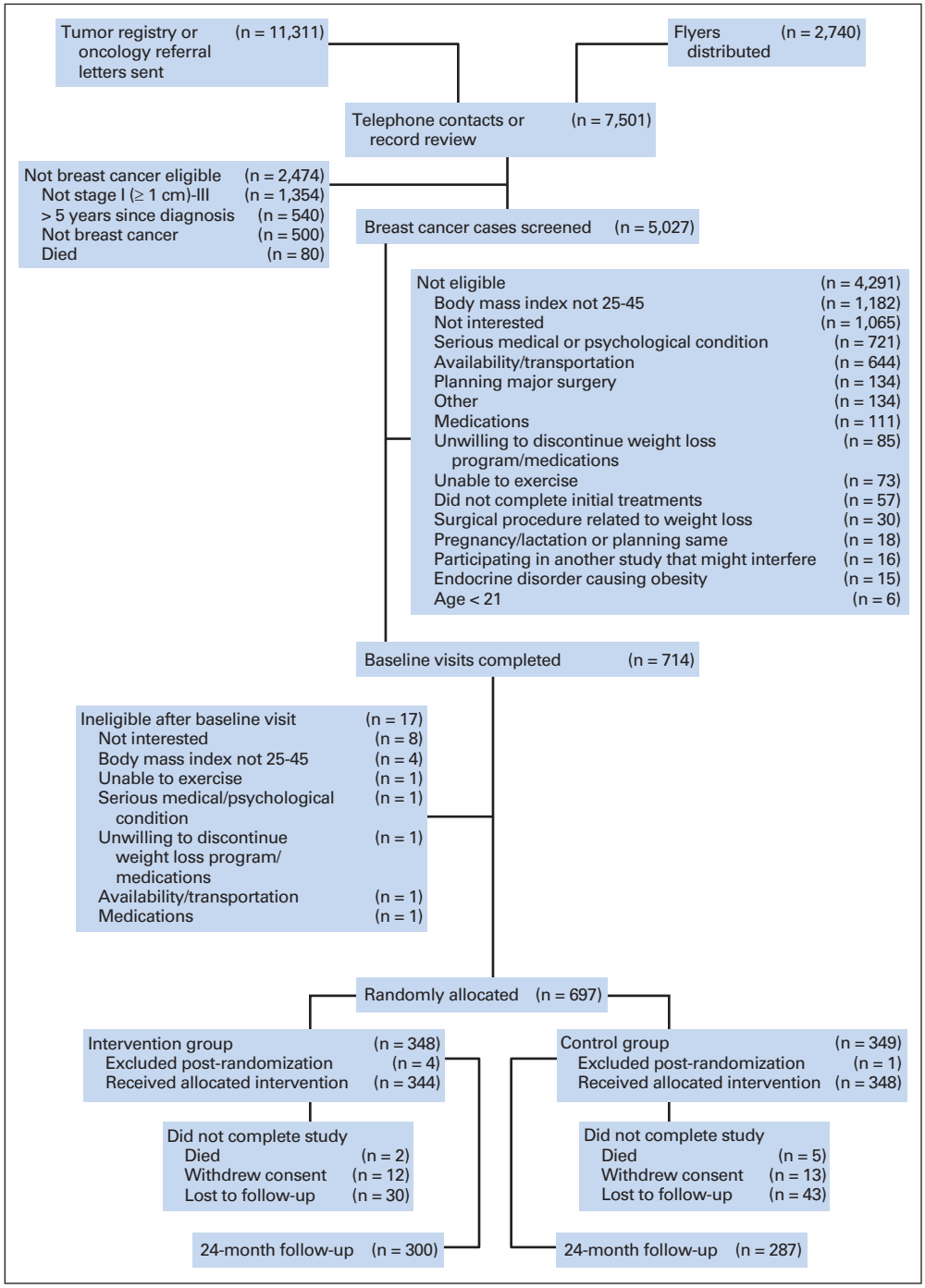

Fig 1. Participant flow during enrollment, exclusions during screening, and clinic visit participation.

semi-structured weight loss program supplemented with telephone counseling and tailored newsletters to promote weight loss through increased physical activity and reduced energy intake relative to expenditure. The study was approved and monitored by the institutional review boards of all sites, and participants provided written informed consent.

Study Population

Study participants were recruited and managed at four sites (San Diego, CA; Denver, CO; St Louis, MO; and Birmingham, AL). Inclusion criteria were age ≥ 21 years; a history of breast cancer (stage I [≥ 1 cm], II, or III) diagnosed within the previous 5 years; completion of initial therapies not including endocrine therapy; body mass index (BMI) of 25 to 45 kg/m^2; and ability to comply with study procedures. Exclusion criteria included history of malignancies other than initial breast cancer, except nonmelanoma skin cancer; serious psychiatric illness; and any medical condition substantially limiting moderate physical activity. Figure 1 presents the participant flow during recruitment and follow-up. Random assignment was performed by a centralized computer process, assigning participants in a 1:1 ratio to either the intervention arm or the less intensive intervention control arm, stratified by age (< or ≥ 55 years), stage (I *v* others [II and III]), and study site.

As previously described,[10] 693 women with a history of invasive breast cancer were initially enrolled onto the study. Since publication of that article, one additional postrandomization exclusion was approved by the data and safety monitoring board, leaving an analytic sample of 692 women (344 women in the intervention group and 348 controls).

Interventions

Intervention details have been reported previously.[10] The goal of the intervention was a 7% weight loss at 2 years after random assignment. Briefly, the intervention began with an intensive phase that consisted of 4 months of weekly 1-hour group sessions for closed groups of an average of 15 women, tapering to every other week for 2 months. From 6 months onward, the groups met monthly for the remainder of the first year. The strategies and guidance discussed in the group sessions were reinforced by brief (10- to 15-minute) personalized guidance delivered by telephone and/or e-mail.

The goal of dietary guidance was to promote a reduction in energy intake, aiming for a deficit of 500 to 1,000 kcal a day relative to expenditure. The physical activity goal was an average of at least 60 minutes per day of purposeful exercise at a moderate level of intensity.

Tailored print newsletters provided additional support when the groups met less frequently. Newsletters were provided quarterly from 6 to 24 months; were individually tailored based on information about physical activity, dietary intake, and weight; and provided guidance for overcoming barriers to increase physical activity and regulate dietary intake.

Control group participants were provided weight management resources and materials in the public domain. An individualized diet counseling session was provided at baseline and 6 months, and current physical activity recommendations (at least 30 minutes per day) were advised. Control group participants also received monthly telephone calls and/or e-mails from the study coordinator and were invited to attend optional informational seminars on aspects of healthy living other than weight control every other month during the first year.

Measures

Height was measured at baseline, and weight was measured at baseline and at 6-, 12-, 18-, and 24-month follow-up clinic visits. Waist circumference was measured at baseline and 12 and 24 months. Blood pressure was measured at all clinic visits following standardized procedures. Two blood pressure measurements using a conventional mercury sphygmomanometer were obtained, with the reported value being the mean of these measures.

Physical activity was assessed using the modified Godin Leisure-Time Exercise Questionnaire, which has been validated previously in cancer research.[11] The modified Godin Leisure-Time Exercise Questionnaire consists of three questions regarding the frequency and duration of mild, moderate, and strenuous exercise performed during free time in a typical week. Total weekly minutes of moderate and strenuous exercise were calculated.

Fitness level was obtained by measuring recovery heart rate after a 3-minute step test, and measurements were compared with previously published standards to determine fitness level.[12] Good to excellent fitness corresponds to the lowest recovery heart rate tertile among age-matched women in a large community health study,[12] and poor to fair fitness corresponds to the highest two tertiles of recovery heart rate.

Statistical Analysis

Comparability of the study groups was examined using *t* tests for continuous variables and χ^2 tests for categorical variables. Longitudinal mixed models were used to analyze weight change over time. This method allows for missing data while using all available records. As planned and approved in the study protocol,[10] the primary analysis treats all missing weights as resulting from a missing at random process, with sensitivity analyses conducted around that assumption. Thus, any missing data were assumed to be missing at random, and a sensitivity analysis comparing weights of those who did and did

Table 1. Characteristics of Study Participants

Characteristic	% of Patients	
	Control (n = 348)	Intervention (n = 344)
Age, years		
Mean	56	56
SD	9	9
30-44	9.8	13.1
45-54	32.8	30.5
≥ 55	57.5	56.4
Race/ethnicity		
Non-Hispanic white	81.0	77.0
African American	10.1	10.5
Hispanic	5.8	7.6
Mixed/other	3.2	4.9
Postmenopausal at study entry	82.8	79.9
Weight at study entry, kg		
Mean	84.7	85.0
SD	13.8	14.3
Body mass index at study entry, kg/m^2		
Mean	31.4	31.6
SD	4.6	4.7
25–29.9	45.1	46.2
30–34.9	35.1	29.7
35–45	19.8	24.1
Years between primary treatment and study entry		
Mean	2.18	2.02
SD	0.55	0.55
Breast cancer stage		
I	31.9	32.0
II	51.7	48.6
III	16.4	19.5
Tumor estrogen receptor status		
Positive	77.3	77.0
Negative	22.7	23.0
Chemotherapy		
Yes	75.3	77.0
No	24.7	23.0
Antiestrogen use		
None	23.0	25.2
SERM only	23.3	20.2
Any AI	53.7	54.6

NOTE. There were no statistically significant differences between the groups.
Abbreviations: AI, aromatase inhibitor; SD, standard deviation; SERM, selective estrogen receptor modulator.

not complete the 24-month clinic visit was done. For outcomes, the analysis used a mixed model that computed least square mean differences of the treatment-time interaction (equivalent to contrast statements). The study had 90% power to detect a mean weight change of 2.75 kg, the primary end point.[10]

Subgroup analysis (per protocol) analyzed weight loss at 24 months in subgroups defined by a median split of time since breast cancer diagnosis, tumor receptor status, and type of therapy. We also examined differential weight loss by categories of race/ethnicity and age. Percent weight loss was modeled separately for intervention participants and controls using regression models with a single predictor of interest. When significant subgroup associations were identified, a multivariable regression model controlled jointly for predictors of interest. Variables that were related to intervention weight loss when used singly, but that lost statistical significance in the multivariable model, were further analyzed with bivariate tests to describe the association (and lack of independence) of some of the variables. $P \leq .05$ was considered statistically significant, without adjustment for multiple testing in secondary analysis.

RESULTS

No statistically significant between-group differences were observed at baseline (Table 1). At the 6-, 12-, and 18-month time points, the intervention group had a lower mean weight and BMI than the control group (Table 2). At 6 months of follow-up, mean weight loss in the intervention group was 5.9% of initial weight. At 12 months, this weight loss (6.0% of initial weight) was maintained, and at 18 months, it was 4.7% below the baseline weight. At 24 months, the intervention group was 3.7% lighter than it was at study entry. On average, the control group lost 1.3%, 1.5%, 1.3%, and 1.1% at the 6-, 12-, 18-, and 24-month follow-up visits, respectively. In intervention women, percentage of weight lost at 24 months did not differ by BMI category (overweight: mean, 3.9%; SEM, 0.5%; obese class 1: mean, 3.1%; SEM, 0.9%; obese class 2: mean, 5.4%; SEM, 1.1%; obese class 3: mean, 0.8%; SEM, 1.6%).

At 12 months, 55% of the intervention group participants had lost $\geq$ 5% of their initial weight, and 26% had lost $\geq$ 10% of initial weight. At 24 months, 44% of intervention group participants were at a weight that was $\geq$ 5% lower than initial weight, and 15% were $\geq$ 10% less than initial weight. Among the control group participants, a considerably lower proportion of participants achieved those degrees of weight loss (Fig 2).

Weight was not available for 44 intervention group and 61 control group participants at 24 months (Fig 1). Noncompleters did not differ from completers in baseline weight or 6-month weight, but they were heavier than completers at 12 months (overall: 86.6 *v* 81.2 kg, respectively, $P = .03$; intervention group, 88.5 *v* 79.3 kg, respectively).

Both systolic and diastolic blood pressure were lower in the intervention group than the control group at follow-up clinic visits, as shown in Table 3 ($P \leq .05$ except for diastolic blood pressure at 12 months). At the 6- and 12-month clinic visits, the intervention group reported greater moderate/strenuous physical activity (238 and 212 minutes per week, respectively) than the control group (163 and 139 minutes per week, respectively; $P < .001$). However, at the 18- and 24-month clinic visits, reported physical activity levels were similar in both groups and were considerably lower than those reported by the intervention group at the two earlier follow-up time points. Recovery heart rates after the step test were lower in the intervention group than controls at 6 months (52 *v* 54 beats per minute; $P = .09$; Table 3), and at study end, 40% of intervention group women were classified as having a step test heart rate of good to excellent compared with 32% of controls ($P = .09$).

In the control group, none of the subgroup categories were statistically significantly associated with 24-month weight loss (Table 4).

Table 2. Weight and Other Anthropometric Measurements

Measurement	Intervention		Control		
	No. of Women	Mean (SEM)	No. of Women	Mean (SEM)	*P**
Weight, kg					
Baseline	344	85.0 (0.8)	348	84.7 (0.7)	.77
6 months	315	80.0 (0.8)	305	83.5 (0.8)	.002
12 months	297	79.7 (0.9)	288	83.5 (0.9)	.003
18 months	278	80.6 (0.9)	262	83.5 (0.9)	.02
24 months	300	81.4 (0.9)	287	83.8 (0.9)	.13
Change from baseline, %					
6 months	315	−5.9 (0.3)	305	−1.3 (0.3)	< .001
12 months	297	−6.0 (0.4)	288	−1.5 (0.4)	< .001
18 months	278	−4.7 (0.4)	262	−1.1 (0.4)	< .001
24 months	300	−3.7 (0.4)	287	−1.3 (0.4)	< .001
Body mass index, kg/m^2					
Baseline	344	31.6 (0.3)	348	31.4 (0.2)	.50
6 months	315	29.7 (0.3)	305	31.0 (0.3)	.001
12 months	297	29.7 (0.3)	288	30.9 (0.3)	.003
18 months	278	30.0 (0.3)	262	30.8 (0.3)	.03
24 months	300	30.3 (0.3)	287	31.0 (0.3)	.14
Waist, cm					
Baseline	344	104.9 (0.7)	348	103.5 (0.7)	.13
12 months	275	97.8 (0.7)	247	100.4 (0.7)	.004
24 months	272	99.4 (0.7)	259	100.4 (0.7)	.21

*P value represents group-time interaction in a longitudinal mixed effects model for the variable of interest.

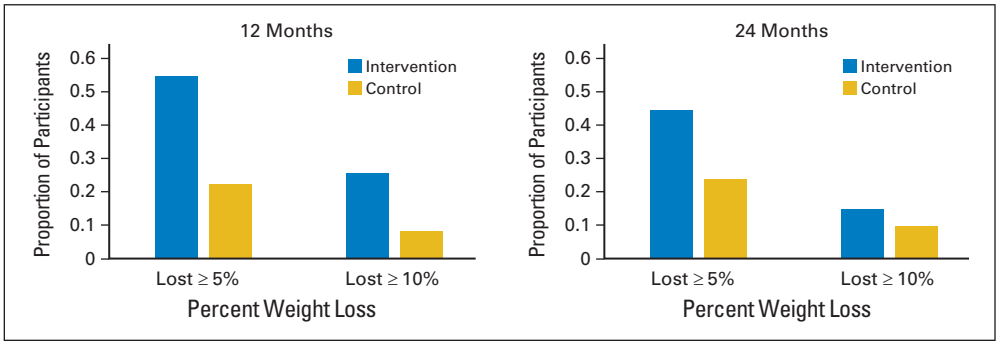

Fig 2. Proportion of study participants achieving a weight loss of more than 5% and more than 10% of initial weight at 12 and 24 months.

In the intervention group, 24-month weight loss did not vary by time between completion of primary treatment and study entry (Table 4). However, intervention women who had received chemotherapy lost less weight at 24 months (3% of initial weight) than those who had not received chemotherapy (6.1% of initial weight; $P < .01$). Likewise, intervention women on aromatase inhibitor therapy were more successful at losing weight during the trial than those who did not use these agents (4.7% *v* 2.5%, respectively). We observed no racial/ethnic differences in weight loss.

Age at study entry was strongly associated with weight loss in the intervention women. At 24 months, women younger than age 45 years had a mean weight loss of 0%, compared with 2.1% for those age 45 to 54 years and 5.2% for those age 55 years or older ($P < .001$; Table 4). However, intervention women in the youngest age group (30 to 44 years) reported as much or more physical activity at each time point than women in other age groups. The youngest group reported a mean of 110 minutes (standard deviation [SD], 132 minutes) of weekly moderate or vigorous physical activity at baseline and 181 minutes

Table 3. Clinic Visit Measures

Measure	Intervention		Control		
	No. of Women	Mean (SEM) or %	No. of Women	Mean (SEM) or %	*P**
Systolic blood pressure, mmHg					
Baseline	344	124 (0.9)	347	125 (0.8)	.18
6 months	294	119 (0.9)	280	123 (0.9)	.001
12 months	278	121 (0.9)	255	123 (1)	.001
18 months	254	121 (1)	234	124 (1)	.007
24 months	274	122 (1)	265	124 (1)	.05
Diastolic blood pressure, mmHg					
Baseline	344	77 (0.5)	347	78 (0.5)	.56
6 months	294	74 (0.5)	280	76 (0.6)	.002
12 months	278	75 (0.6)	255	76 (0.6)	.11
18 months	254	75 (0.6)	234	77 (0.6)	.005
24 months	274	75 (0.6)	265	77 (0.6)	.05
Physical activity, minutes of moderate or strenuous activity per week					
Baseline	343	94 (7)	348	103 (8)	.47
6 months	294	238 (11)	280	163 (10)	< .001
12 months	269	212 (11)	245	139 (9)	< .001
18 months	249	168 (9)	226	158 (12)	.29
24 months	256	165 (10)	250	157 (11)	.67
Step test recovery heart rate, beats per minute					
Baseline	340	57 (0.6)	348	56 (0.5)	.44
6 months	272	52 (0.6)	252	54 (0.6)	.09
12 months	245	52 (0.6)	213	52 (0.6)	.46
18 months	207	52 (0.7)	180	53 (0.7)	.39
24 months	215	51 (0.6)	206	52 (0.6)	.37
Step test heart rate, % good to excellent					
Baseline	340	23.5	348	23.6	.97
6 months	272	41.9	252	33.3	.01
12 months	245	42.9	213	36.2	.04
18 months	207	39.6	180	37.2	.48
24 months	215	40.0	206	32.0	.09

**P* value represents group-time interaction in a longitudinal mixed effects model for the variable of interest.

Table 4. Weight Change Across Participant Subgroups

Factor	Intervention		Control		Intervention		Control	
	No. of Women	Mean Baseline Weight (kg; SEM)	No. of Women	Mean Baseline Weight (kg; SEM)	Mean % Weight Loss at 24 Months (SEM)	*P**	Mean % Weight Loss at 24 Months (SEM)	*P**
Time between primary treatment and study entry						.27		.49
≤ 23 months	182	85.2 (1.1)	169	85.7 (1.1)	3.2 (0.6)		0.9 (0.6)	
> 23 months	160	84.9 (1.1)	178	83.6 (0.9)	4.2 (0.6)		1.5 (0.6)	
Estrogen receptor status						.06		.91
Positive	261	84.6 (0.9)	255	84.9 (0.9)	4.2 (0.5)		1.3 (0.5)	
Negative	78	87.1 (1.6)	75	84.5 (1.4)	2.2 (1.0)		1.2 (1.1)	
Progesterone receptor status						.33		.75
Positive	218	84.8 (1.0)	225	85.1 (0.9)	3.9 (0.5)		1.4 (0.5)	
Negative	117	85.8 (1.4)	104	84.0 (1.3)	3.0 (0.8)		1.1 (1.0)	
HER2 status						.40		.08
Positive	52	86.0 (2.0)	47	86.0 (1.9)	3.2 (0.9)		3.1 (1.2)	
Negative	277	84.9 (0.8)	268	84.7 (0.8)	3.8 (0.5)		1.0 (0.5)	
Chemotherapy						.002		.87
Yes	265	85.7 (0.8)	262	85.0 (0.9)	3.0 (0.5)		1.2 (0.5)	
No	79	82.6 (1.5)	86	83.8 (1.5)	6.1 (0.8)		1.4 (0.7)	
Antiestrogen use						.05		.54
None	86	85.5 (1.5)	77	85.1 (1.4)	2.4 (1.0)		0.9 (1.1)	
SERM only	69	85.1 (1.6)	78	85.9 (1.5)	2.7 (0.9)		0.6 (0.8)	
Any AI	186	84.8 (1.1)	180	83.8 (1.0)	4.7 (0.5)		1.7 (0.6)	
Race/ethnicity						.15		.80
Non-Hispanic white	265	84.5 (0.8)	282	84.9 (0.9)	4.0 (0.5)		1.3 (0.5)	
African American	36	94.5 (2.3)	35	89.2 (2.2)	1.3 (1.2)		0.4 (1.3)	
Hispanic	26	79.3 (2.8)	20	78.1 (2.9)	1.9 (1.8)		1.8 (1.5)	
Mixed/other	17	81.6 (3.3)	11	76.3 (4.2)	5.4 (2.0)		3.0 (1.1)	
Age, years						< .001		.15
30-44	45	85.3 (2.4)	34	89.8 (2.6)	0.0 (1.2)		-0.7(1.6)	
45-54	105	84.9 (1.2)	114	84.1 (1.2)	2.1 (0.9)		0.7 (0.6)	
55-82	194	84.9 (1.1)	200	84.2 (1.0)	5.2 (0.5)		1.9 (0.6)	

Abbreviations: AI, aromatase inhibitor; HER2, human epidermal growth factor receptor 2; SERM, selective estrogen receptor modulator.
**P* value represents within-group weight loss difference by subgroup category.

(SD, 173 minutes) at 24 months. Women age 55 to 82 years reported a mean of 92 minutes (SD, 123 minutes) at baseline and 155 minutes (SD, 170 minutes) at 24 months.

In a multivariable model (controlled for baseline weight, tumor estrogen receptor status, treatment, intervention group, age, and race/ethnicity), intervention assignment and age were strong predictors of maintained weight loss at 24 months ($P < .001$), but chemotherapy and aromatase inhibitors were no longer associated with weight loss. The bivariate associations between weight loss with chemotherapy and aromatase inhibitors seem to be a result of collinearity with age (data not shown).

DISCUSSION

A group-based behavioral weight loss intervention, supplemented with personal contact and support, can promote weight loss among overweight or obese breast cancer survivors that is comparable to that achieved in the general population of obese adults.[13,14] Behavioral treatment programs of this type typically result in an initial weight loss of 5% to 10% of baseline weight, which has been shown to confer health benefits in the general population of adults, individuals at risk for diabetes, and those with type 2 diabetes.[13,14] Women who have been diagnosed and treated for breast cancer often have special issues and problems, such as treatment-related adverse effects, fatigue, and depression, that can complicate weight management efforts. Results from the ENERGY trial demonstrate that weight loss, although modest, and increased physical activity can be achieved in this population, suggesting that these problems can be overcome.

In a recent systematic evidence review for the US Preventive Services Task Force, behavioral interventions targeting obese adults that had 12 to 26 counseling sessions per year were associated with a 6% weight loss and promoted significantly more weight loss than programs with fewer sessions.[13] Current practice guidelines recommend as an initial goal the loss of 5% to 10% of baseline weight within 6 months but also recognize that a sustained weight loss of 3% to 5% of body weight may lead to clinically meaningful reductions in some cardiovascular risk factors.[15]

Results of this study can be compared with the LISA (Lifestyle Intervention in Adjuvant Treatment of Early Breast Cancer) trial, an RCT of a telephone-based weight loss intervention in 338 postmenopausal women with breast cancer receiving letrozole.[16] The degree of weight loss achieved in that study was similar, although slightly less, than in the this study (intervention arm *v* control arm: 5.3% *v* 0.7% at 6 months and 3.6 *v* 0.4% at 24 months, respectively). Two larger studies in breast cancer survivors

that are currently under way are examining the effect of a lifestyle intervention to promote weight control on cancer outcomes.[17,18]

As observed in all behavioral weight loss studies, preventing weight regain when support and contact are reduced, as it was in the second year of the participants' involvement in this study, is a challenge. Results from previous reviews indicate that an intervention group who, on average, loses 5% to 10% of initial weight during the intervention will maintain an average of 50% of that weight loss at 1 year and 44% of that loss at 2 years.[16] Biologic factors contribute to weight regain, such as reduced resting energy expenditure in association with a reduced body mass, but the primary problem seems to be deteriorating adherence to behavioral changes relating to diet and exercise.[19,20] Various strategies have been identified as promoting long-term weight loss maintenance,[14,21] such as self-monitoring, increased physical activity, cognitive restructuring to attenuate response to lapses, and regular planned meals. However, extending the length of treatment and support has been shown to be one of the most potentially effective strategies for promoting maintenance of weight loss.[22]

Oncology providers can help patients make healthy lifestyle choices that promote weight control, and the ASCO statement includes guidelines for education and referral.[8] Resources and specific strategies such as those used in the ENERGY behavioral intervention are available in booklets for oncologists and patients and on ASCO's patient Web site.

Analysis of potentially influencing characteristics, such as time since diagnosis and type of tumor and therapy, revealed that only intervention group and age were variables independently predictive of weight loss. Differential weight loss in association with chemotherapy or use of aromatase inhibitors seems to be a result of the clinical association with age and treatments. Less weight loss in younger compared with older intervention group participants may be attributable to both physiologic and psychosocial factors. Premature menopause is a common consequence of chemotherapy and occurs in the majority of women who are premenopausal at diagnosis and is accompanied by physiologic changes that can affect the energy balance (eg, increased truncal fat, reduced lean mass).[23] Also, younger breast cancer survivors are more likely to have young children, family obligations, and work demands that make it more difficult to make dietary modifications and achieve daily exercise goals, as well as greater psychosocial distress after diagnosis.[24,25] Younger breast cancer survivors may need counseling and resources beyond that of a semi-structured behavioral weight loss program, as used in this study, to successfully achieve weight loss. Efforts exploring social media and new communication tools merit further investigation.

As with all trials, this study had limitations. Although weight was available at 12 and 24 months for 85% of the randomized participants, indicating a relatively low drop-out rate for a weight loss study, our sensitivity analysis suggested that participants from whom 24-month weight data were unavailable were heavier than completers at 12 months. Also, the data on physical activity were self-reported, and it is known that study participants often do not accurately report their levels of physical activity.[26] The population was predominantly non-Hispanic white, so optimal subgroup analysis to assess differential response across race/ethnicities was not possible. Future studies that develop and test interventions tailored for Hispanic or minority breast cancer survivors who are overweight or obese are needed.

In conclusion, a behavioral weight loss intervention can induce clinically meaningful weight loss in overweight or obese breast cancer survivors, comparable to that observed in the general population. A 4% to 6% weight loss will move many breast cancer survivors toward an optimal body weight, and this degree of intentional weight loss has been shown to substantially reduce circulating levels of estrogens and cytokines, which may be drivers of breast cancer recurrence.[27] Younger breast cancer survivors may need counseling and resources beyond that of a semi-structured behavioral weight loss program, as used in this study, to successfully achieve weight loss. Ultimately, there is a need for larger, longer term trials to test the effects of intentional weight loss on breast cancer recurrence and survival.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Disclosures provided by the authors are available with this article at www.jco.org.

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Support

Supported by National Cancer Institute (NCI) Grant No. CA148791. Management of stored biologic samples at the University of California, San Diego (UCSD) Coordinating Center was facilitated by the Diet and Physical Activity Shared Resource of the Moores UCSD Cancer Center (NCI Cancer Center Support Grant No. CA23100). The Colorado Clinical Translational Sciences Institute grant (National Institutes of Health [NIH] Grant No. TR001082) supported study activities at the University of Colorado. This publication also was made possible by Grant No. UL1 RR024992 from the National Center for Research Resources, a component of the NIH, and NIH Roadmap for Medical Research.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Results of the Exercise and Nutrition to Enhance Recovery and Good Health for You (ENERGY) Trial: A Behavioral Weight Loss Intervention in Overweight or Obese Breast Cancer Survivors

The following represents disclosure information provided by authors of this manuscript. All relationships are considered compensated. Relationships are self-held unless noted. I = Immediate Family Member, Inst = My Institution. Relationships may not relate to the subject matter of this manuscript. For more information about ASCO's conflict of interest policy, please refer to www.asco.org/rwc or jco.ascopubs.org/site/ifc.

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Research Funding: Jenny Craig (Inst), Nestle USA (Inst)

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No relationship to disclose

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No relationship to disclose

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Consulting or Advisory Role: Keryx (I), Merganser Biotech (I), Silarus Therapeutics (I), InformedDNA
Research Funding: Keryx (I)
Patents, Royalties, Other Intellectual Property: Related to iron metabolism and the anemia of chronic disease (I)
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Research Funding: Medivation (Inst), Astellas Pharma (Inst), Genentech (Inst), Eisai (Inst), Lilly/ImClone (Inst), CytRx Corporation (Inst)

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Research Funding: GI Dynamic, Norvo Nordisk, American Beverage Association
Patents, Royalties, Other Intellectual Property: UpToDate

Acknowledgment

We thank the data and safety monitoring committee: Bernard Rosner, PhD; Joanne Mortimer, MD; Ken Fujioka, MD; Frank Greenway, MD; and Linda Litzau. We thank Catherine Alfano, PhD (Program Officer); Julia Rowland, PhD, National Institutes of Health (NIH) Office of Cancer Survivorship; and Robert Croyle, PhD, NIH Division of Cancer Control and Population Sciences, for their assistance, guidance, and support. We also thank Lea Jacinto for her assistance in article preparation and submission. Finally, we thank the Alvin J. Siteman Cancer Center at Washington University School of Medicine and Barnes-Jewish Hospital in St Louis, Missouri, for the use of the Tissue Procurement Core, which provided sample storage and processing (supported in part by National Cancer Institute Cancer Center Support Grant No. CA91842).